Patent
Attorney's Docket No. 154546/0341-073

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Marcello PUGGIONI et al.	)	Confirmation No.: 5190
	)	
Application No.: 10/572,170	)	Group Art Unit: 3745
	)	
Filed: January 2, 2007	)	Examiner: Dwayne J. White
	)	
For: HEAT EXCHANGER FOR CENTRIFUGAL COMPRESSOR GAS SEALING	)	

APPEAL BRIEF PURSUANT TO 37 C.F.R § 41.37

Sir:

Further to the Notice of Appeal filed on March 30, 2011 and in connection with the above-identified application submitted herewith are the Appeal Brief and the fee set forth in § 41.20(b)(2).

I. REAL PARTY IN INTEREST

The real party in interest is the assignee, General Electric Company.

II. RELATED APPEALS AND INTERFERENCES

To the best of the undersigned's knowledge, there are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-13 are currently pending, have all been rejected two or more times, and are all the subject of this appeal.

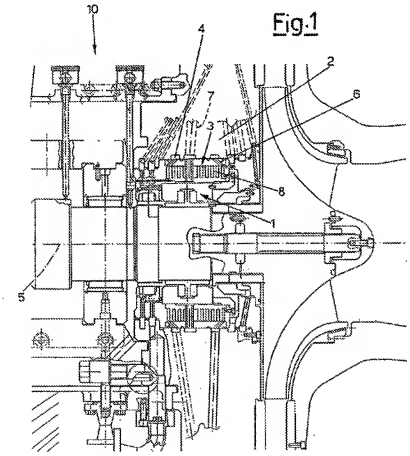
IV. STATUS OF AMENDMENTS

No Amendments have been submitted in this application after the Office Action issued on December 30, 2010. Appellants note that the Office Action of December 30, 2010 was improperly made FINAL since it included a new rejection. Following this Office Action, Appellants have renewed their appeal by filing a Notice of Appeal on March 30, 2011.

V. **SUMMARY OF CLAIMED SUBJECT MATTER**

Appellants' claimed invention is directed to a heat exchanger device for a gas seal for centrifugal compressor. The device includes a fluid heat exchanger 3 (see Figure 1 reproduced below) positioned between the gas seal 1 of the compressor 10 and the housing wall of the seal, shown as flange 2, with at least one inlet duct 7 through the fluid heat exchanger configured to supply a blockage gas to the gas seal.

Fig.1



During compressor operation the temperature of the gas flowing through the compressor rises as a result of compression, also raising the temperature of the

walls/flanges which surround the gas compression area. The compressed gas and/or wall temperatures could raise the temperature of the gas seal to the point at which seal materials can degrade or fail (more than 200°C). The fluid heat exchanger is configured such that the heat exchanger keeps the temperature of the gas seal at an acceptably low temperature (100°C). See page 1, lines 23-25, page 2, lines 5-19; page 3, lines 16-18; page 4, lines 13-21; and page 5, lines 16-20.

Further, in order to provide improved cooling effect, the fluid heat exchanger is circular so as to surround the gas seal and extends between the gas seal and a supporting flange for the seal. The fluid heat exchanger includes at least one inlet opening 4 connected to an outlet opening 6 by a coiled path 8, thus a cooling liquid such as water circulates more than one complete rotation around the fluid heat exchanger before exiting the heat exchanger. See page 3, lines 13-22.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

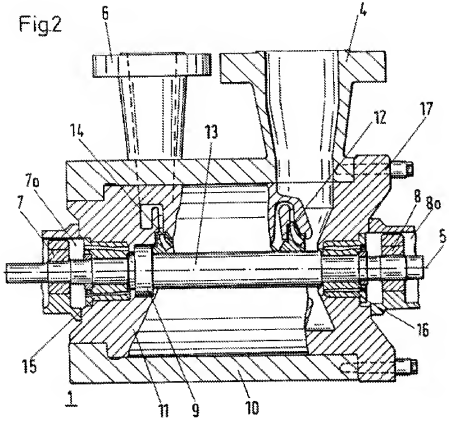
A number of grounds of rejection are raised by the Examiner and listed below. Appellants request review of the following grounds of rejection on appeal.

1. The rejection of claim 12 under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement;
2. The rejection of claims 1-13 under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,718,560 to Lorenzen (hereinafter "Lorenzen"); and
3. The rejection of claims 1-12 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Lorenzen in view of U.S. Patent No. 4,872,689 to Drumm ("Drumm").

VI. ARGUMENT

A. Review of the applied references

Lorenzen is directed to an arrangement for a dry-gas sliding ring seal in a turbomachine. The arrangement is configured to supply heat to the leakage flow during standstill of the turbomachine thereby raising the temperature of the leaking flow to a temperature similar to that during its operation, in order to suppress an undercooling in the region of the dry-gas sliding ring seal with all its negative effects. The sought-after effect of the arrangement is starting-up the turbomachine in a substantially safer operating state. (See Lorenzen's Abstract and col. 1 lines 25-34.)



In Figure 2 reproduced above and the corresponding description, Lorenzen discloses a turbocompressor having dry-gas sliding ring seals 15/16 sealing a rotor 13 from an inner part 11. A heating device 18 prevents the temperature of a leakage flow (passing through a ring space 31 between a first stage 12 of the turbomachine and the suction side seal as shown in Figure 3) from cooling below the operating temperature. (See also col. 3 line 6 to col. 4, line 14 of Lorenzen.)

Drumm is directed to mechanical seals with heat exchangers. In particular, in Drumm, an annular heat exchanger 12 surrounds an annular seal 22 (see Figure 1 of Drumm reproduced on the next page). A heat exchange medium is supplied to the heat

exchanger 12 via an inlet 52 and output thereof via an outlet 54 (see, e.g., col. 5, lines 15-18 of Drumm).

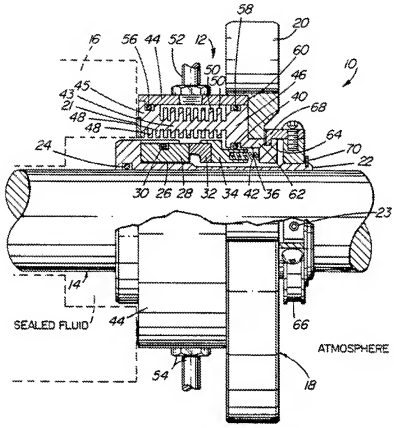


FIG. 1

B. Claim 12 complies with the written description requirement under 35 U.S.C. §112, first paragraph.

Claim 12 recites that "the fluid heat exchanger is configured to reduce a temperature of the gas seal from more than 200°C to around 100°C." The originally filed specification states on page 2, lines 5-7, that "[w]hen the temperatures at the

compressor delivery are higher than 200°C, there is a sudden perishing of the washers, o-rings and vital parts of the gas seal." The specification then points to the necessity of a device "which creates an acceptable environment for the gas seal in the case of high temperatures." See page 2, lines 17-19. Objectives of the invention are then described as including providing "a heat exchanger device which does not allow the gas seal to reach the temperature of the process gas" and "a device which allows the cooling of the gas seal." See page 2, lines 21-23 and line 25 to page 3 line 1. Using water circulated through the exemplary device described in the specification "cools the internal surface of the exchanger 3 creating an acceptable temperature (100° C) for the gas seal." See page 5 lines 16-20. Thus, the claimed range is explicitly supported by the original specification.

The Examiner takes the position that because the two temperatures are mentioned at different points in the specification and not "referred to as a function of the heat exchanger device" the claimed temperature range is not supported by the specification. However, being mentioned in the same point of the specification or being "referred to as a function of the heat exchanger device" are not valid criteria for evaluating whether the claimed features comply with written description requirement. As stated in *Ralston Purina Co. v. Far-Mar-Co, Inc.*, 772 F.2d 1570, 1575 (Fed. Cir. 1985) (quoting *In re Kaslow*, 707 F.2d 1366, 1375 (Fed. Cir. 1983)), the test for determining compliance with the written description requirement of 35 U.S.C. § 112, first paragraph, is whether the disclosure of the application as originally filed "reasonably

conveys to the artisan that the inventor had possession at that time of the later claimed subjected matter," rather than the presence or absence of literal support in the specification for the claim language. As described above, the application makes clear to an artisan that the claimed invention lowers the temperature of the gas seal to an acceptable level, i.e., around 100°C, from a level that would harm the gas seal, i.e., more than 200°C.

C. Claims 1-11 and 13 are patentable over Lorenzen

i. Independent Claim 1

Independent Claim 1 is directed to a fluid heat exchanger device including a heat exchanger and an inlet duct through the fluid heat exchanger to supply a blockage gas to the gas seal. The heat exchanger is configured to keep the temperature of the seal low in case of high temperatures of the wall and/or compressed gas (emphasis ours).

The Examiner rejects Claim 1 taking the position that there is no structural difference between Lorenzen and the claimed invention, the only difference being Applicants' intention to use a cooling fluid rather than a heating fluid (the Examiner asserting that Lorenzen is inherently capable of providing also a cooling fluid).

However, not only does Lorenzen differ in (1) intent (i.e., heating in Lorenzen rather than the claimed cooling) and (2) purpose (i.e., reducing potential damage from a low-temperature leakage flow at start-up in Lorenzen versus the claimed maintaining of the seal in an acceptable temperature range during compressor operation when

exposed to high temperatures from both the compressed gas and surrounding wall), Lorenzen also differs in (3) structure as discussed next.

The structural difference is rooted in the fact that the fluid heat exchanger 18 of Lorenzen is not configured to modify the temperature of the seal, but it is specifically configured to modify the temperature of the leakage flow in a ring space 31 located between a first stage 12 of the turbomachine and the suction side seal (e.g., 16 in Figure 2) as shown in Figure 3 of Lorenzen. Thus, even if Lorenzen's heater were capable of cooling the gas (which feature Appellants do not believe to be inherent or obvious), Lorenzen does not describe changing the temperature of the seal. Therefore, this rejection does not comply with MPEP 2143.03, which states "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson* 40 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Moreover, the heating device 18 of Lorenzen is not located between the gas seal of the compressor 16 (or more specifically, 24/25 in Figure 3) and a housing wall of the seal 11 (per Examiner's assertion), but forward (on the left side in Figure 3) of the gas seal, the heating device 18 being configured to heat the leakage gas in the ring space 31. Note that Lorenzen teaches the sliding gas seal 24/25 and related seal components are held in place by shaft sleeves 20a, 20b, 20c and the seal housing consisting of the outer seal housing 21a, intermediate piece 21b and inner seal housing 21c, which even more particularly points out the structural differences. Even if the first stage of the turbocompressor 12 was considered a heat exchanger as the Examiner suggested, it is

not located between the seal 15/16 (24/25) and wall 11 nor actual seal housing components 21a, b, and c.

Because of the manner in which the heating device 18 of Lorenzen is positioned, the structure in Lorenzen does not anticipate "at least one inlet duct entering through the fluid heat exchanger and configured to supply a blockage gas to the gas seal" (emphasis added). The previous positioning should be taken into consideration when considering whether the applied reference's duct corresponds to the claimed duct. When, as claimed, the "fluid heat exchanger positioned between the gas seal of the compressor and a housing wall" an artisan understands a sandwich-type arrangement and then the at least one duct penetrating through the fluid heat exchanger (in the middle of the arrangement) to provide the blockage gas to the gas seal (at a lower layer of the arrangement). However, Lorenzen does not disclose such a structure.

At least for these reasons Appellants respectfully submit that the rejection of claim 1 as allegedly being anticipated by Lorenzen is improper and should be reversed.

All of the remaining claims depend directly or indirectly from independent claim 1. In addition to inheriting patentably distinguishing features from claim 1, the dependent claims recite additional features further distinguishing over Lorenzen as discussed below for claims 2-4 and 6-7.

ii. Dependent Claim 2

Claim 2 further claims that the exchanger is circular suitable for enveloping the

seal. The configuration of the heating device taught by Lorenzen includes an inlet 18b and an outlet 18c but the ring shaped heating chamber 18a does not completely envelope the area in which heat is transferred as the ring space 18a is interrupted in the peripheral direction by intermediate wall 29. See col. 4, lines 7 and 21-22, and figures 3 and 4, Figure 4 cut along line IV-IV. Note that Lorenzen's bore 40 is provided in the intermediate wall to supply a blockage gas, while in the present application the analogous supply duct 7 is surrounded by the heat exchanger.

iii. Dependent Claim 3

Claim 3 claims the heat exchanger extending between the seal and a supporting flange of the seal. As noted above with respect to claim 1, Lorenzen fails to teach the fluid heat exchanger positioned between the gas seal and the housing wall, thus Lorenzen also fails to teach the more particular arrangement between the gas seal and supporting flange claimed herein. In fact the fluid heat exchanger 18 is not in contact with the seals.

iv. Dependent Claim 4

Claim 4 claims a coiled path between an inlet opening and the outlet opening for flowing a cooling liquid through the exchanger device. Lorenzen fails to teach a coiled path, but instead as previously discussed teaches a single peripheral path 18a for its heating fluid that is interrupted by intermediate wall 29. A coiled path requires at least one continuously complete rotation around the periphery.

v. Dependent Claim 6

Claim 6 claims the exchanger is configured to receiving a cooling liquid. As noted above with respect to claim one, Lorenzen is configured to heat and only suggest use of a heating fluid to impart heat to the leakage gas flow.

vi. Dependent Claim 7

Claim 7 claims the coiled path of claim 4 completely enclosing the gas seal. Lorenzen does not include a coiled path as discussed with respect to claim 4 above, nor a fluid heat exchanger completely enclosing the gas seal, but only has a heat exchanger area in contact with the leakage flow gas.

D. Claims 1-11 and 13 are patentable over Lorenzen and Drumm

In the outstanding Office Action of December 30, 2011, the Examiner newly rejected claims 1-12 as allegedly being unpatentable over Lorenzen and Drumm. In the rejection (see pages 4-5 of the outstanding Office Action), the Examiner asserts that Lorenzen discloses all of the claimed subject matter except for the heat exchanger being configured to cool the seal."

Although the structure disclosed in Drumm may perform either heating or cooling (depending on a temperature of the heat exchange medium supplied to the heat exchanger 12 via an inlet 52 and output thereof via an outlet 54), this structure fundamentally differs from the claimed invention because in Drumm there is no "inlet duct entering through the fluid heat exchanger and configured to supply a blockage gas

to the gas seal" as recited in claim 1.

Independent Claim 1 is directed to a fluid heat exchanger having two elements: a fluid heat exchanger and at least one inlet duct. One of the two elements of the claimed structure is missing in Drumm. On the other hand, as argued above, Lorenzen fails to anticipate the claimed structure, a difference between Lorenzen and the claimed structure being more than the mere heating versus cooling as asserted by the Examiner.

Therefore, Appellants respectfully submit that claim 1 and claims 2-13 depending directly or indirectly from claim 1 are not rendered obvious by combining the teachings of Lorenzen and Drumm.

Conclusions

Appellants respectfully submit that claim 12 complies with the written description requirement under 35 U.S.C. §112, first paragraph, as the originally filed patent application fully supports applicants claimed invention including a fluid heat exchanger configured to cool a gas seal from over 200°C to about 100°C. Applicants further respectfully submit that claims 1-13 are not anticipated by Lorenzen or rendered obvious by the combination of Lorenzen and Drumm. Reversal of all outstanding rejections is therefore respectfully requested.

Respectfully submitted,

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/Luminita A. TODOR/

Date: June 30, 2011

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VIII. CLAIMS APPENDIX

1. A heat exchanger device for a gas seal for a centrifugal compressor, the device comprising:

a fluid heat exchanger positioned between the gas seal of the compressor and a housing wall of said seal; and

at least one inlet duct entering through the fluid heat exchanger and configured to supply a blockage gas to the gas seal, wherein the fluid heat exchanger is configured to keep the temperature of said seal low in the case of high temperatures of the wall and/or compressed gas.

2. The exchanger device according to claim 1, wherein said exchanger is a circular exchanger suitable for enveloping said seal.

3. The exchanger device according to claim 1, wherein said exchanger extends between said seal and a supporting flange of said seal.

4. The exchanger device according to claim 1, wherein said exchanger further comprises:

at least one inlet opening; and

at least one outlet opening connected to each other by a coiled path, said path for flowing a cooling liquid through said exchanger device.

5. The exchanger device according to claim 1, wherein said at least one inlet duct passes through the centre of the exchanger.

6. The exchanger device according to claim 1, wherein the exchanger is configured to receive a cooling liquid.

7. The exchanger device according to Claim 4, wherein the coiled path completely encloses the gas seal.

8. The exchanger device according to Claim 1, wherein the fluid heat exchanger is configured to reduce a temperature of the gas seal.

9. The exchanger device according to Claim 1, further comprising:

a shaft configured to rotate inside the fluid heat exchanger.

10. The exchanger device according to Claim 9, further comprising:

an impeller attached to the shaft.

11. The exchanger device according to Claim 10, further comprising:

a centrifugal compressor including the impeller.

12. The exchanger device according to Claim 1, wherein the fluid heat exchanger is configured to reduce a temperature of the gas seal from more than 200°C to around 100°C.

13. The exchanger device according to Claim 6, wherein the cooling liquid is water.

IX. **EVIDENCE APPENDIX**

None.

X. **RELATED PROCEEDINGS APPENDIX**

None.